60/239,662, filed October 12, 2000, entitled "Methods for Solid Phase Nanoextraction and Desorption."

CLAIMS:

Replace the claims of record **1-10** and **12-14** with the amended claims below. A marked-up version of the amended claims is provided on separate sheets following the remarks.

1. (amended) A method for extracting a plurality of analytes from a sample, comprising the steps of:

providing a plurality of extraction probes capable of adsorbing analytes, wherein each extraction probe comprises a freestanding particle and an extraction phase;

contacting said extraction probes with a sample suspected of comprising at least one of the analytes; and

separating said extraction probes from the sample.

2. (amended) The method of claim 6, wherein said solid support comprises a nanoparticle.

3. (amended) The method of claim 2 wherein said nanoparticle comprises a nanobarcode.

4. (amended) The method of claim 6, wherein said solid support comprises a bead.

5. (amended) The method of claim 6, wherein said solid support comprises a fiber.

6. (amended) A method for extracting a plurality of analytes from a sample, comprising the steps of:

providing a plurality of extraction probes capable of adsorbing analytes, wherein each extraction probe comprises a solid support and a combinatorially-derived extraction phase;

contacting said extraction probes with a sample suspected of comprising at least one of the analytes; and

separating said extraction probes from the sample.

7. (amended) The method of claim 6, wherein said extraction phase comprises a polymer.

8. (amended) The method of claim 6, further comprising the step of detecting for at least one analyte extracted from said sample.

9. (amended) A method for simultaneously conducting a plurality of assays to a plurality of analytes comprising:

contacting a solution that may contain the analytes with a plurality of extraction probes, wherein each extraction probe comprises a freestanding particle and an extraction phase, and wherein the nature of each extraction phase is encoded by a freestanding particle to which it is associated; and

detecting for the presence of at least one analyte associated with said extraction probes.

10. (amended) A method for extracting a plurality of analytes from a sample, comprising the steps of:

providing a position-addressable array of extraction probes, each probe comprising a solid support and an extraction phase;

providing an array of capillaries addressable by the array of extraction probes, the capillaries containing aliquots of the sample;

contacting the array of extraction probes with the array of capillary tubes such that the extraction probes are positioned within the capillary tubes;

separating the array of extraction probes from the array of capillaries, such as that the extraction probes are separated from the sample.

11. The method of claim 10 wherein each capillary tube comprises a different sample.

12. (amended) An assembly comprising at least 100 differentiable extraction probes, each extraction probe comprising a solid support and an extraction phase, wherein said extraction probes comprise a plurality of different types of extraction phases.

13. (amended) The assembly of extraction probes of claim 12 wherein the nature of the extraction phases are encoded by the solid supports.

14. (amended) The assembly of extraction probes of claim 12 wherein the solid support is a nanoparticle.

Add new claims **15** through **63** as follows:

15. The method of claim 1 wherein said extraction probes are differentiable, and wherein the method further comprises distinguishing between at least two different separated extraction probes.

16. The method of claim 15 wherein said extraction probes are encoded, and wherein said separated extraction probes are distinguished in dependence on said encoding.

17. The method of claim 15 wherein said separated extraction probes are distinguished by an optical method.

18. The method of claim 17 wherein said separated extraction probes are distinguished by a method selected from the group consisting of

absorbance, fluorescence, Raman, hyperRaman, Rayleigh scattering, hyperRayleigh scattering, CARS, sum frequency generation, degenerate four wave mixing, forward light scattering, back scattering, and angular light scattering.

19. The method of claim 15 wherein said separated extraction probes are distinguished by a method selected from the group consisting of near field scanning optical microscopy, atomic force microscopy, scanning tunneling microscopy, chemical force microscopy, lateral force microscopy, transmission electron microscopy, scanning electron microscopy, field emission scanning electron microscopy, electrical methods, mechanical methods, magnetic detection methods, and SQUID.

20. The method of claim 1 further comprising detecting at least one analyte associated with said separated extraction probes.

21. The method of claim 20 wherein said detecting step comprises quantifying said associated analyte.

22. The method of claim 20 wherein said detecting step comprises identifying said associated analyte.

23. The method of claim 1 wherein at least one of said extraction phases is selected from the group consisting of hydrophobic materials, hydrophilic materials, acids, bases, polyclonal antibodies, monoclonal antibodies, aptamers, small molecule receptors, polymers, molecular solids, non-molecular solids, metals, metal ions, cations, and anions.

24. The method of claim 1 wherein at least one of said extraction phases is selected from the group consisting of a protein, peptide, and nucleic acid, and wherein

said at least one extraction phase interacts with an analyte selected from the group consisting of a protein, peptide, and nucleic acid.

25. The method of claim 1, wherein providing a plurality of different extraction probes comprises providing at least 100 different extraction probes.

26. The method of claim 25, wherein providing a plurality of different extraction probes comprises providing at least 1000 different extraction probes.

27. The method of claim 26, wherein providing a plurality of different extraction probes comprises providing at least 10,000 different extraction probes.

28. The method of claim 1, wherein said extraction probes are contacted with said sample simultaneously.

29. The method of claim 6 wherein extraction phases of different extraction probes have different analyte specificities.

30. The method of claim 6 wherein at least one of said extraction phases has an affinity for one particular analyte.

31. The method of claim 6 wherein at least one of said extraction phases has an affinity for more than one particular analyte.

32. The method of claim 6 wherein at least one of said extraction phases comprises a polymer.

33. The method of claim 6 wherein at least one of said extraction phases comprises a self-assembled monolayer.

34. The method of claim 6 wherein said extraction phases comprise at least one material selected from the group consisting of a metal alloy, oxide, glass, ceramic, semiconductor, nucleic acid, oligonucleotide, carbohydrate, polysaccharide, peptide, protein, lipid, zeolite, and polyelectrolyte multilayer.

35. The method of claim 6 wherein said extraction phases are generated randomly.

36. The method of claim 6 wherein said extraction phases are selected from a combinatorial library.

37. The method of claim 6 further comprising detecting at least one analyte associated with said separated extraction probes.

38. The method of claim 37 wherein detecting said associated analyte comprises identifying said associated analyte.

39. The method of claim 38 wherein said associated analyte is identified using mass spectrometry.

40. The method of claim 37 wherein detecting said associated analyte comprises quantifying said associated analyte.

41. The method of claim 6 wherein providing a plurality of different extraction probes comprises providing between 4 and 100,000 different extraction probes.

42. The method of claim 41 wherein providing a plurality of different extraction probes comprises providing between 10 and 1000 different extraction probes.

43. The method of claim 6, wherein said extraction probes are contacted with said sample simultaneously.

44. The assembly of claim 14 wherein said solid supports are nanobarcodes.

45. The assembly of claim 12 wherein said solid supports are fibers.

46. The assembly of claim 12 wherein said extraction phases are combinatorially derived.

47. The assembly of claim 12 wherein at least one of said extraction phases is a polymer.

48. The assembly of claim 12 wherein at least one of said extraction phases is an antibody.

49. The assembly of claim 12 wherein at least one of said extraction phases comprises a material selected from the group consisting of hydrophobic materials, hydrophilic materials, acids, bases, polyclonal antibodies, monoclonal antibodies, aptamers, small molecule receptors, polymers, molecular solids, non-molecular solids, metals, metal ions, cations, and anions.

50. The assembly of claim 12 wherein at least one of said extraction phases comprises a material selected from the group consisting of a metal alloy, oxide, glass, ceramic, semiconductor, nucleic acid, oligonucleotide, carbohydrate, polysaccharide, peptide, protein, lipid, zeolite, and polyelectrolyte multilayer.

51. The assembly of claim 12 wherein at least one of said extraction phases is a protein.

52. The assembly of claim 12 wherein at least one of said extraction phases is a self-assembled monolayer.

53. A method for extracting a plurality of analytes from a sample, comprising:
providing at least 200 differentiable extraction probes capable of adsorbing analytes, each differentiable extraction probe comprising a solid support and a different extraction phase;
contacting said differentiable extraction probes with a sample suspected of comprising at least one of said analytes;
separating said differentiable extraction probes from said sample; and
distinguishing among said differentiable extraction probes.

54. The method of claim 53, wherein said differentiable extraction probes are encoded and distinguished in dependence on said encoding.

55. The method of claim 54, wherein said solid supports are encoded.

56. The method of claim 53, wherein at least 1000 differentiable extraction probes are provided.

57. The method of claim 53, wherein at least 10,000 differentiable extraction probes are provided.

58. The method of claim 53, wherein said extraction probes are contacted with said sample simultaneously.

59. A method for extracting a plurality of analytes from a sample, comprising:
providing a position-addressable array of extraction probes, each comprising a fiber and an extraction phase, wherein each extraction probe is capable of adsorbing an analyte;